FIG. 1

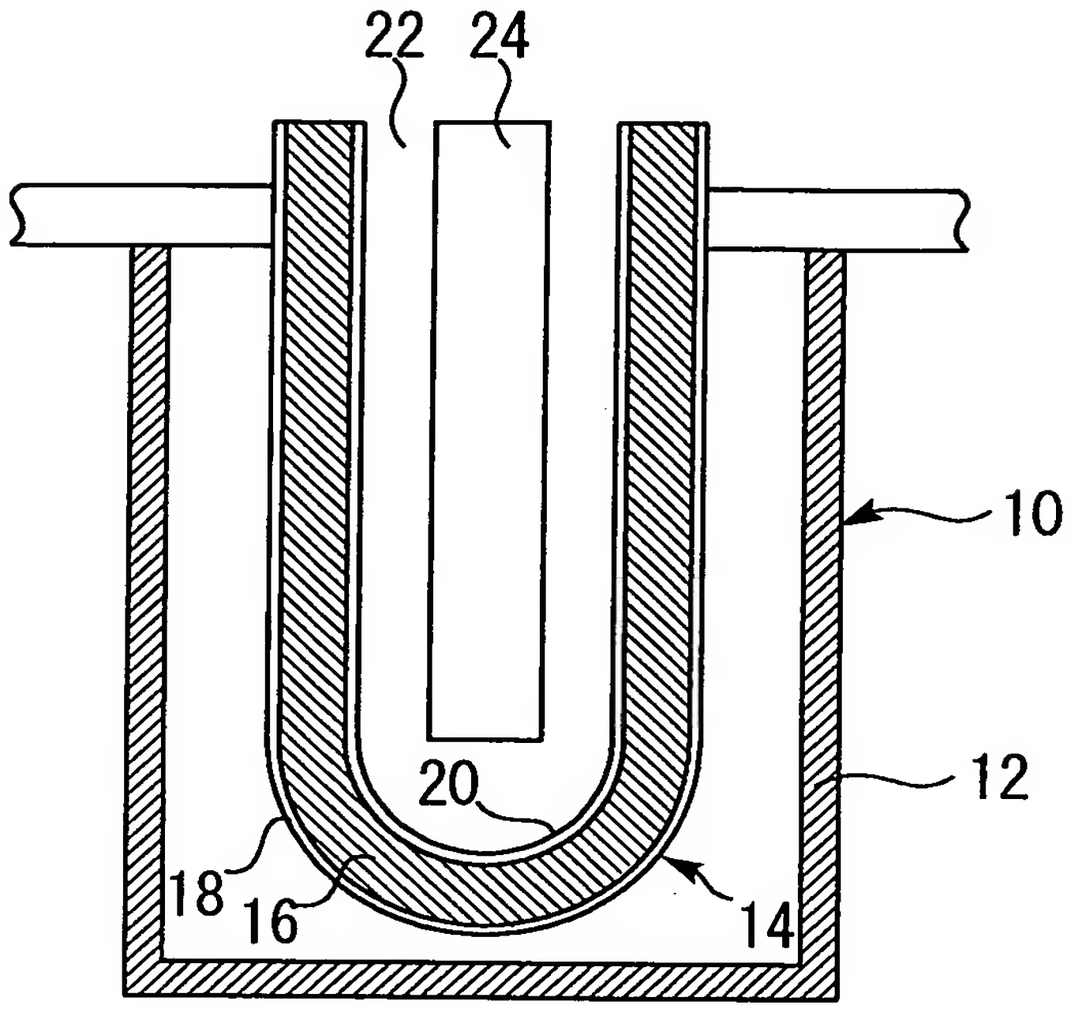
22
24
10
12
20
18
16
14

FIG. 2

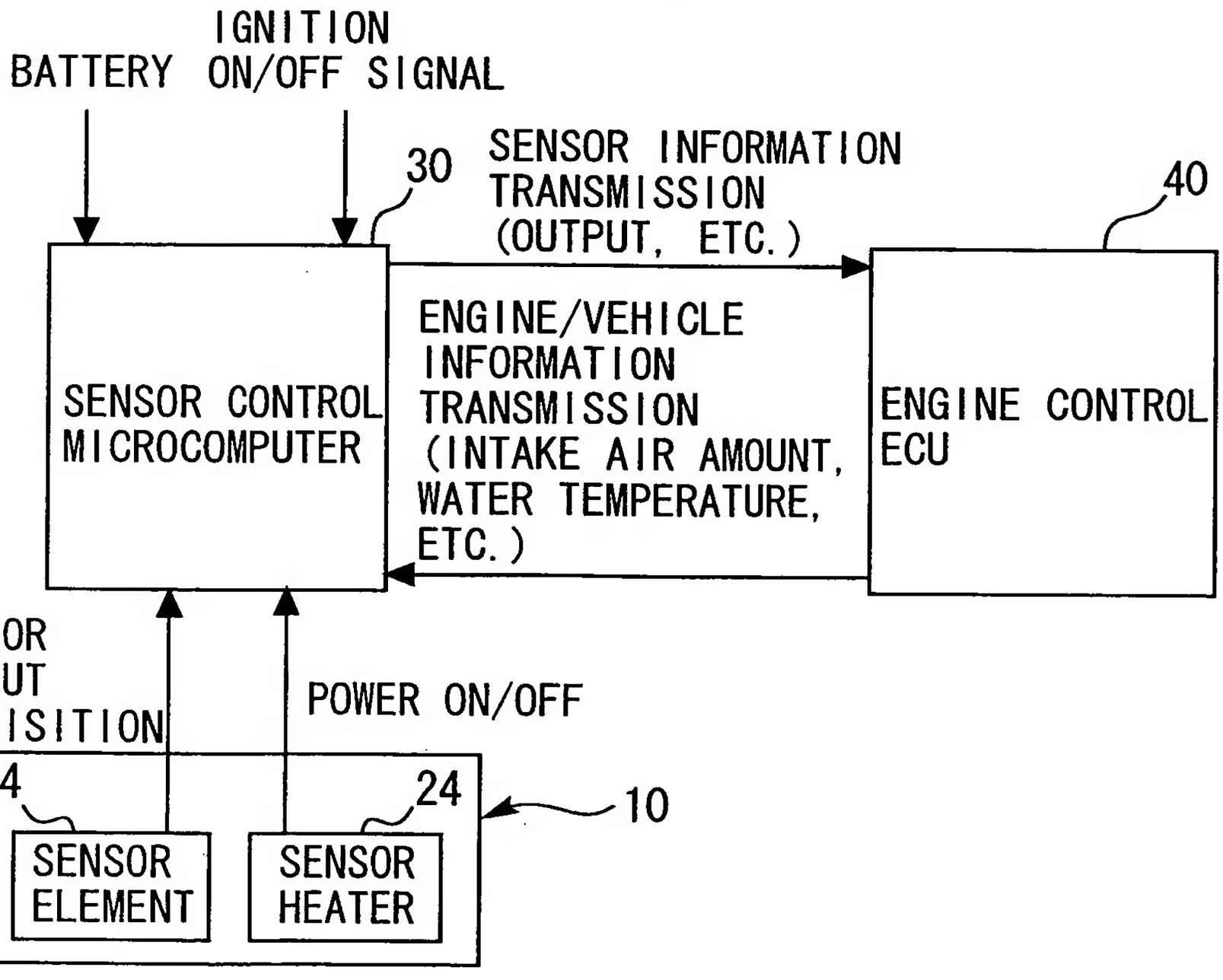
IGNITION
BATTERY ON/OFF SIGNAL
30
SENSOR INFORMATION
TRANSMISSION
(OUTPUT, ETC.)
40
ENGINE/VEHICLE
INFORMATION
TRANSMISSION
(INTAKE AIR AMOUNT,
WATER TEMPERATURE,
ETC.)
SENSOR CONTROL
MICROCOMPUTER
ENGINE CONTROL
ECU
SENSOR
OUTPUT
ACQUISITION
POWER ON/OFF
14
24
10
SENSOR
ELEMENT
SENSOR
HEATER

FIG. 3A

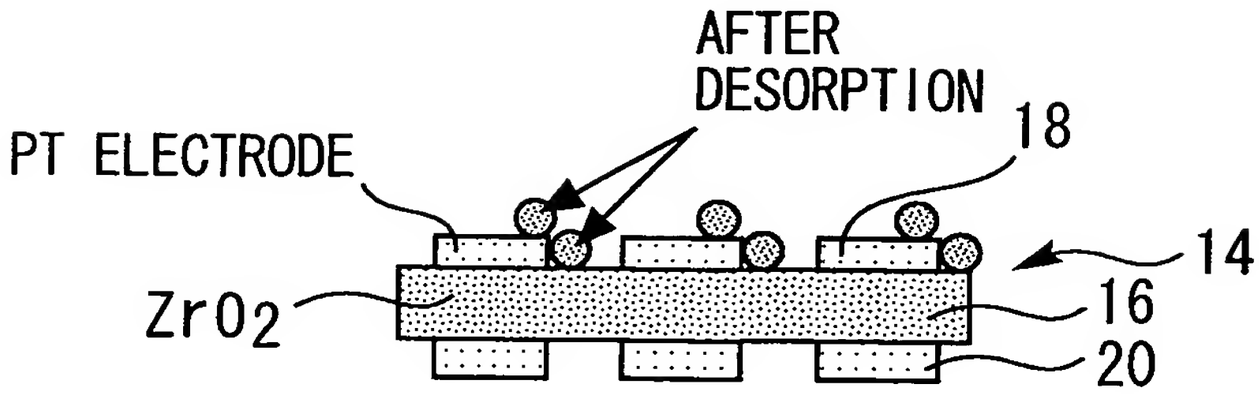

FIG. 3B

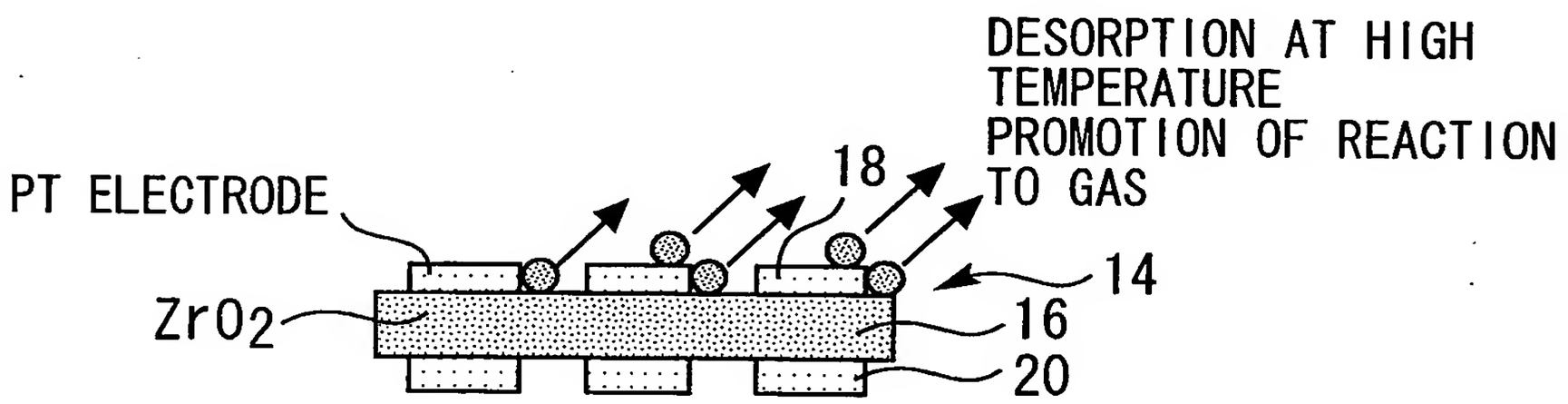

FIG. 4

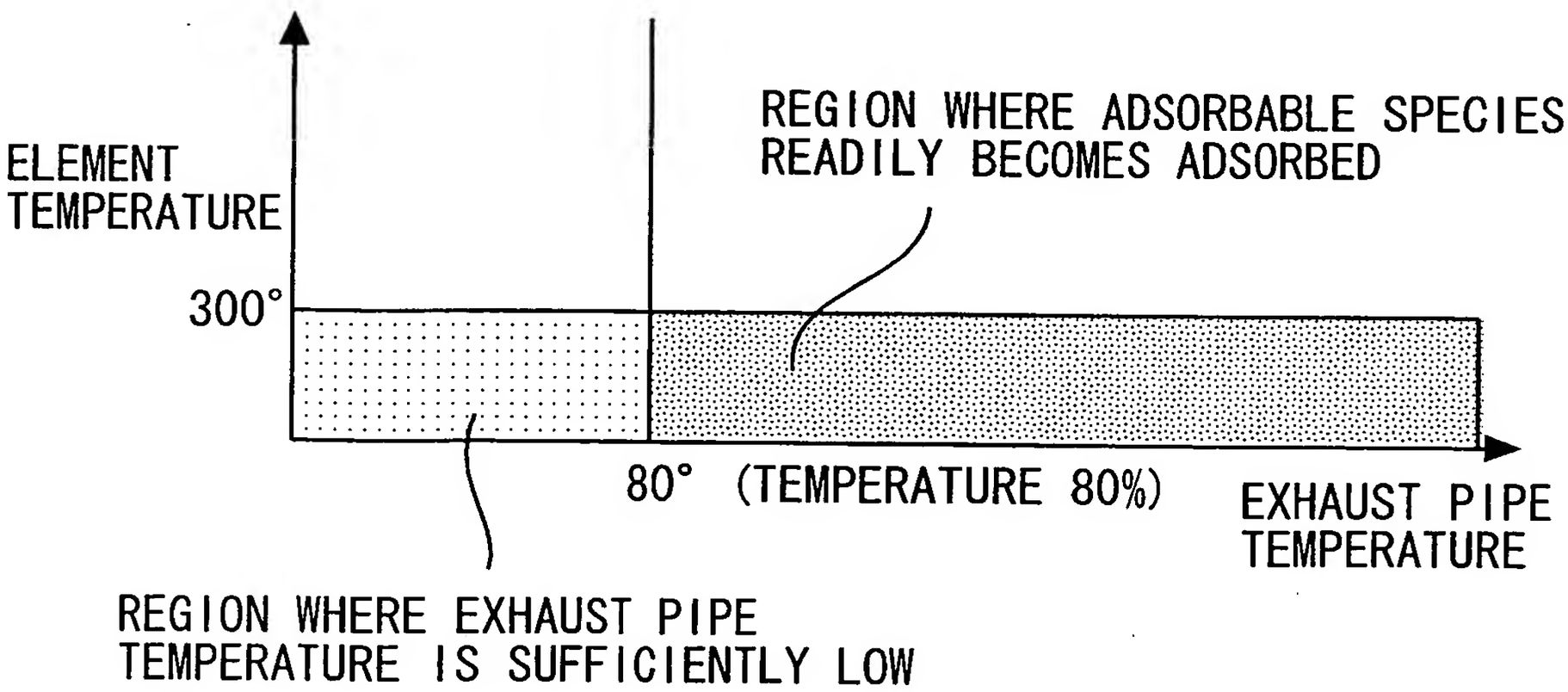

FIG. 5

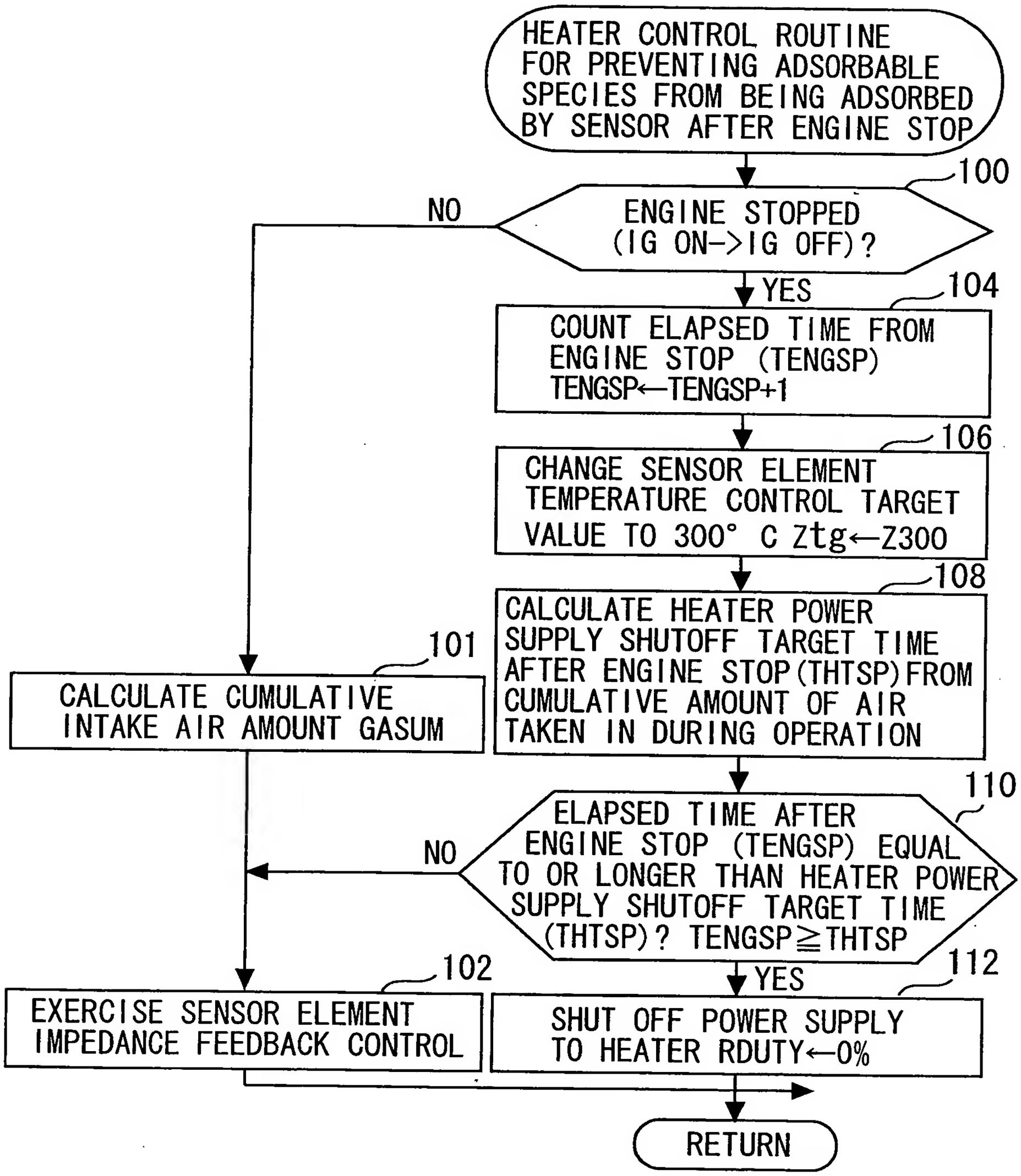
HEATER CONTROL ROUTINE FOR PREVENTING ADSORBABLE SPECIES FROM BEING ADSORBED BY SENSOR AFTER ENGINE STOP
100
ENGINE STOPPED (IG ON->IG OFF)?
NO
YES
104
COUNT ELAPSED TIME FROM ENGINE STOP (TENGSP) TENGSP←TENGSP+1
106
CHANGE SENSOR ELEMENT TEMPERATURE CONTROL TARGET VALUE TO 300° C Ztg←Z300
108
CALCULATE HEATER POWER SUPPLY SHUTOFF TARGET TIME AFTER ENGINE STOP (THTSP) FROM CUMULATIVE AMOUNT OF AIR TAKEN IN DURING OPERATION
101
CALCULATE CUMULATIVE INTAKE AIR AMOUNT GASUM
110
ELAPSED TIME AFTER ENGINE STOP (TENGSP) EQUAL TO OR LONGER THAN HEATER POWER SUPPLY SHUTOFF TARGET TIME (THTSP)? TENGSP≧THTSP
NO
YES
102
EXERCISE SENSOR ELEMENT IMPEDANCE FEEDBACK CONTROL
112
SHUT OFF POWER SUPPLY TO HEATER RDUTY←0%
RETURN

FIG. 6

THTSP MAP FOR GAsum

GAsum[g/S]	3000	10000	50000
THTSP[COUNT]	10000	30000	80000

FIG. 7

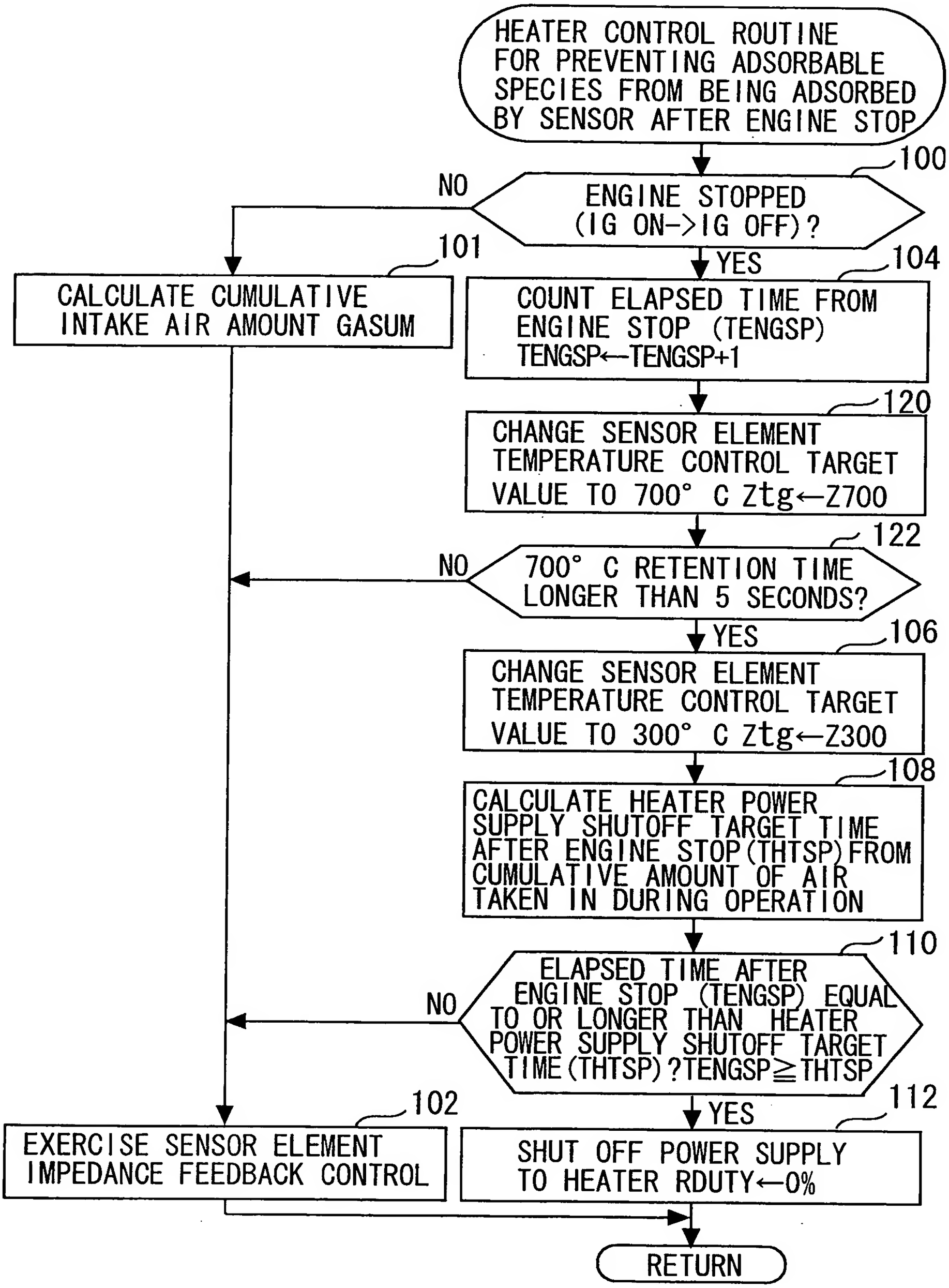
HEATER CONTROL ROUTINE FOR PREVENTING ADSORBABLE SPECIES FROM BEING ADSORBED BY SENSOR AFTER ENGINE STOP
100
ENGINE STOPPED (IG ON->IG OFF)?
NO
YES
101
CALCULATE CUMULATIVE INTAKE AIR AMOUNT GASUM
104
COUNT ELAPSED TIME FROM ENGINE STOP (TENGSP) TENGSP←TENGSP+1
120
CHANGE SENSOR ELEMENT TEMPERATURE CONTROL TARGET VALUE TO 700° C Ztg←Z700
122
700° C RETENTION TIME LONGER THAN 5 SECONDS?
NO
YES
106
CHANGE SENSOR ELEMENT TEMPERATURE CONTROL TARGET VALUE TO 300° C Ztg←Z300
108
CALCULATE HEATER POWER SUPPLY SHUTOFF TARGET TIME AFTER ENGINE STOP(THTSP)FROM CUMULATIVE AMOUNT OF AIR TAKEN IN DURING OPERATION
110
ELAPSED TIME AFTER ENGINE STOP (TENGSP) EQUAL TO OR LONGER THAN HEATER POWER SUPPLY SHUTOFF TARGET TIME(THTSP)?TENGSP≧THTSP
NO
YES
102
EXERCISE SENSOR ELEMENT IMPEDANCE FEEDBACK CONTROL
112
SHUT OFF POWER SUPPLY TO HEATER RDUTY←0%
RETURN

FIG. 8

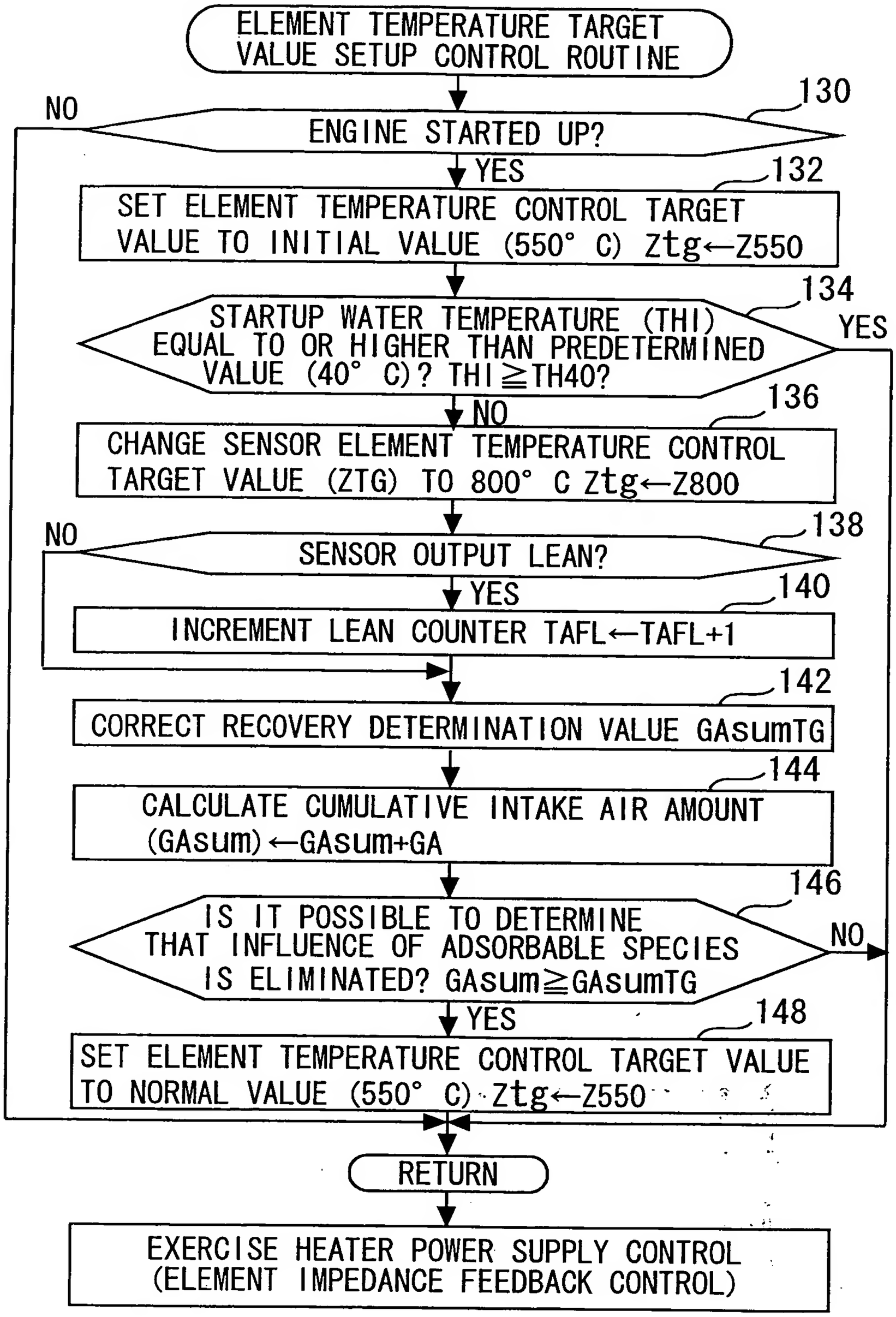
ELEMENT TEMPERATURE TARGET VALUE SETUP CONTROL ROUTINE
130
ENGINE STARTED UP?
NO
YES
132
SET ELEMENT TEMPERATURE CONTROL TARGET VALUE TO INITIAL VALUE (550° C) Ztg←Z550
134
STARTUP WATER TEMPERATURE (THI) EQUAL TO OR HIGHER THAN PREDETERMINED VALUE (40° C)? THI≧TH40?
YES
NO
136
CHANGE SENSOR ELEMENT TEMPERATURE CONTROL TARGET VALUE (ZTG) TO 800° C Ztg←Z800
138
SENSOR OUTPUT LEAN?
NO
YES
140
INCREMENT LEAN COUNTER TAFL←TAFL+1
142
CORRECT RECOVERY DETERMINATION VALUE GAsumTG
144
CALCULATE CUMULATIVE INTAKE AIR AMOUNT (GAsum)←GAsum+GA
146
IS IT POSSIBLE TO DETERMINE THAT INFLUENCE OF ADSORBABLE SPECIES IS ELIMINATED? GAsum≧GAsumTG
NO
YES
148
SET ELEMENT TEMPERATURE CONTROL TARGET VALUE TO NORMAL VALUE (550° C) Ztg←Z550
RETURN
EXERCISE HEATER POWER SUPPLY CONTROL (ELEMENT IMPEDANCE FEEDBACK CONTROL)

FIG. 9

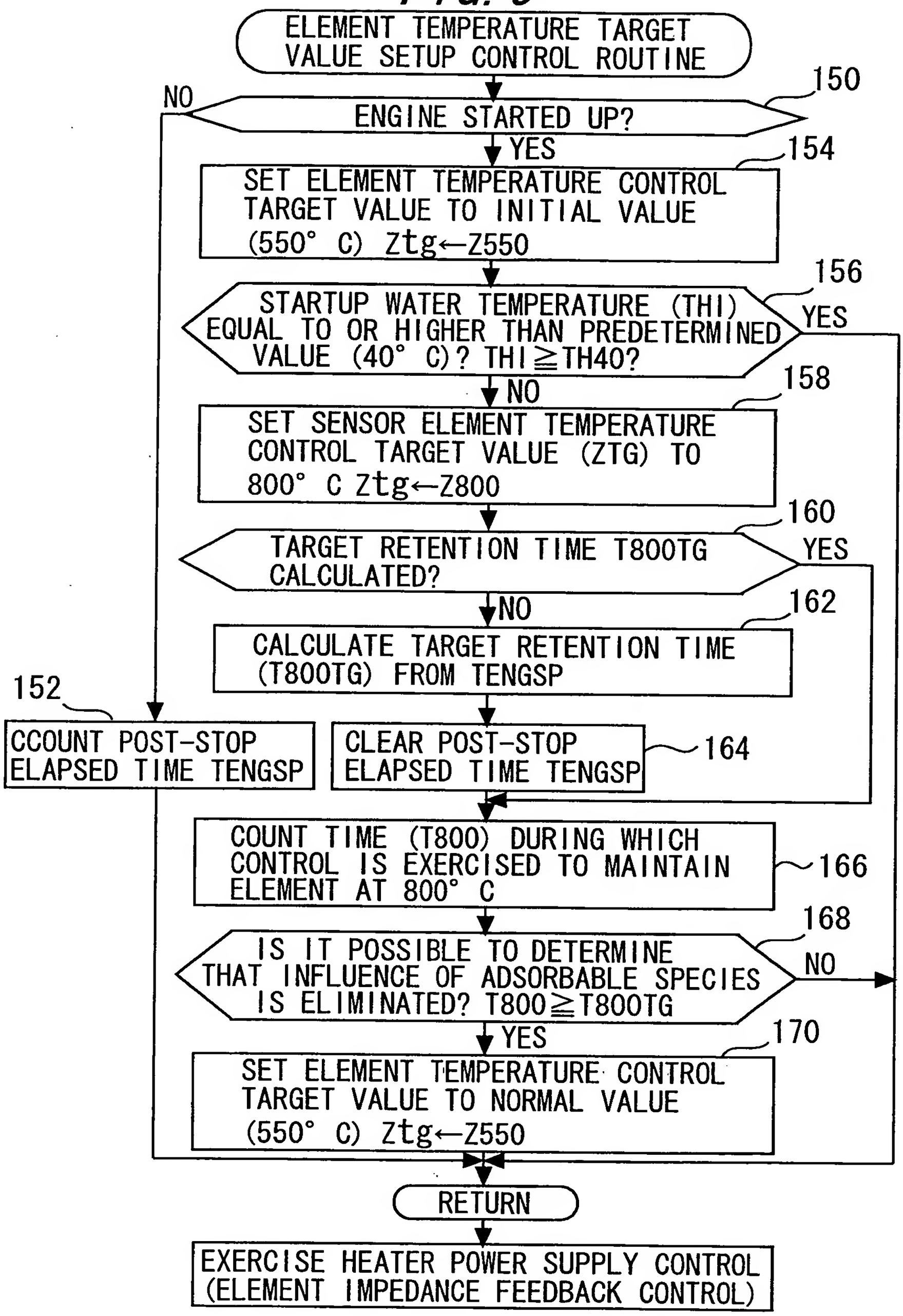
ELEMENT TEMPERATURE TARGET VALUE SETUP CONTROL ROUTINE
150
ENGINE STARTED UP?
NO
YES
154
SET ELEMENT TEMPERATURE CONTROL TARGET VALUE TO INITIAL VALUE (550° C) Ztg←Z550
156
STARTUP WATER TEMPERATURE (THI) EQUAL TO OR HIGHER THAN PREDETERMINED VALUE (40° C)? THI≧TH40?
YES
NO
158
SET SENSOR ELEMENT TEMPERATURE CONTROL TARGET VALUE (ZTG) TO 800° C Ztg←Z800
160
TARGET RETENTION TIME T800TG CALCULATED?
YES
NO
162
CALCULATE TARGET RETENTION TIME (T800TG) FROM TENGSP
152
CCOUNT POST-STOP ELAPSED TIME TENGSP
CLEAR POST-STOP ELAPSED TIME TENGSP
164
COUNT TIME (T800) DURING WHICH CONTROL IS EXERCISED TO MAINTAIN ELEMENT AT 800° C
166
168
IS IT POSSIBLE TO DETERMINE THAT INFLUENCE OF ADSORBABLE SPECIES IS ELIMINATED? T800≧T800TG
NO
YES
170
SET ELEMENT TEMPERATURE CONTROL TARGET VALUE TO NORMAL VALUE (550° C) Ztg←Z550
RETURN
EXERCISE HEATER POWER SUPPLY CONTROL (ELEMENT IMPEDANCE FEEDBACK CONTROL)

FIG. 10

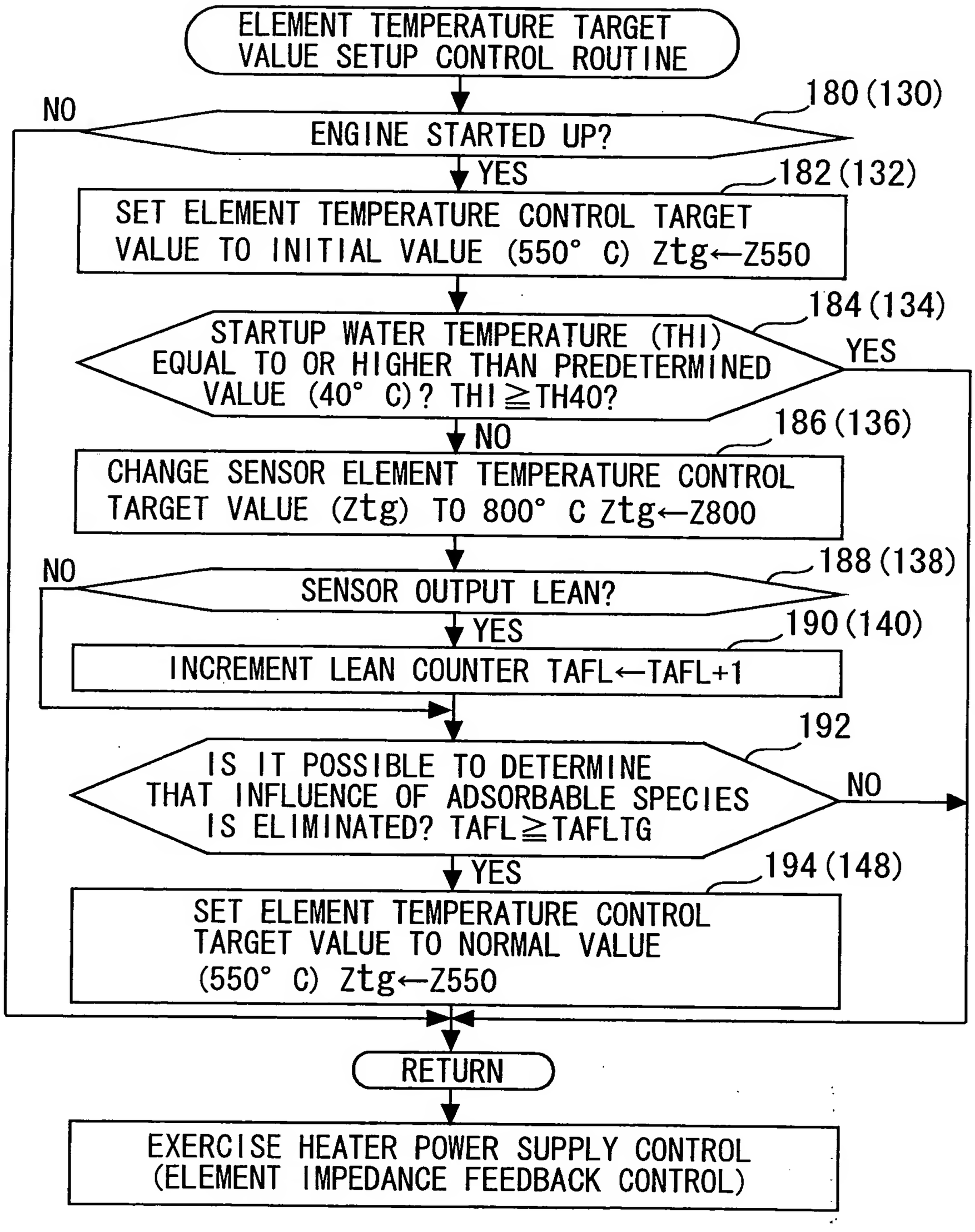
ELEMENT TEMPERATURE TARGET VALUE SETUP CONTROL ROUTINE
180 (130)
ENGINE STARTED UP?
NO
YES
182 (132)
SET ELEMENT TEMPERATURE CONTROL TARGET VALUE TO INITIAL VALUE (550° C) Ztg←Z550
184 (134)
STARTUP WATER TEMPERATURE (THI) EQUAL TO OR HIGHER THAN PREDETERMINED VALUE (40° C)? THI≧TH40?
YES
NO
186 (136)
CHANGE SENSOR ELEMENT TEMPERATURE CONTROL TARGET VALUE (Ztg) TO 800° C Ztg←Z800
188 (138)
SENSOR OUTPUT LEAN?
NO
YES
190 (140)
INCREMENT LEAN COUNTER TAFL←TAFL+1
192
IS IT POSSIBLE TO DETERMINE THAT INFLUENCE OF ADSORBABLE SPECIES IS ELIMINATED? TAFL≧TAFLTG
NO
YES
194 (148)
SET ELEMENT TEMPERATURE CONTROL TARGET VALUE TO NORMAL VALUE (550° C) Ztg←Z550
RETURN
EXERCISE HEATER POWER SUPPLY CONTROL (ELEMENT IMPEDANCE FEEDBACK CONTROL)

FIG. 11

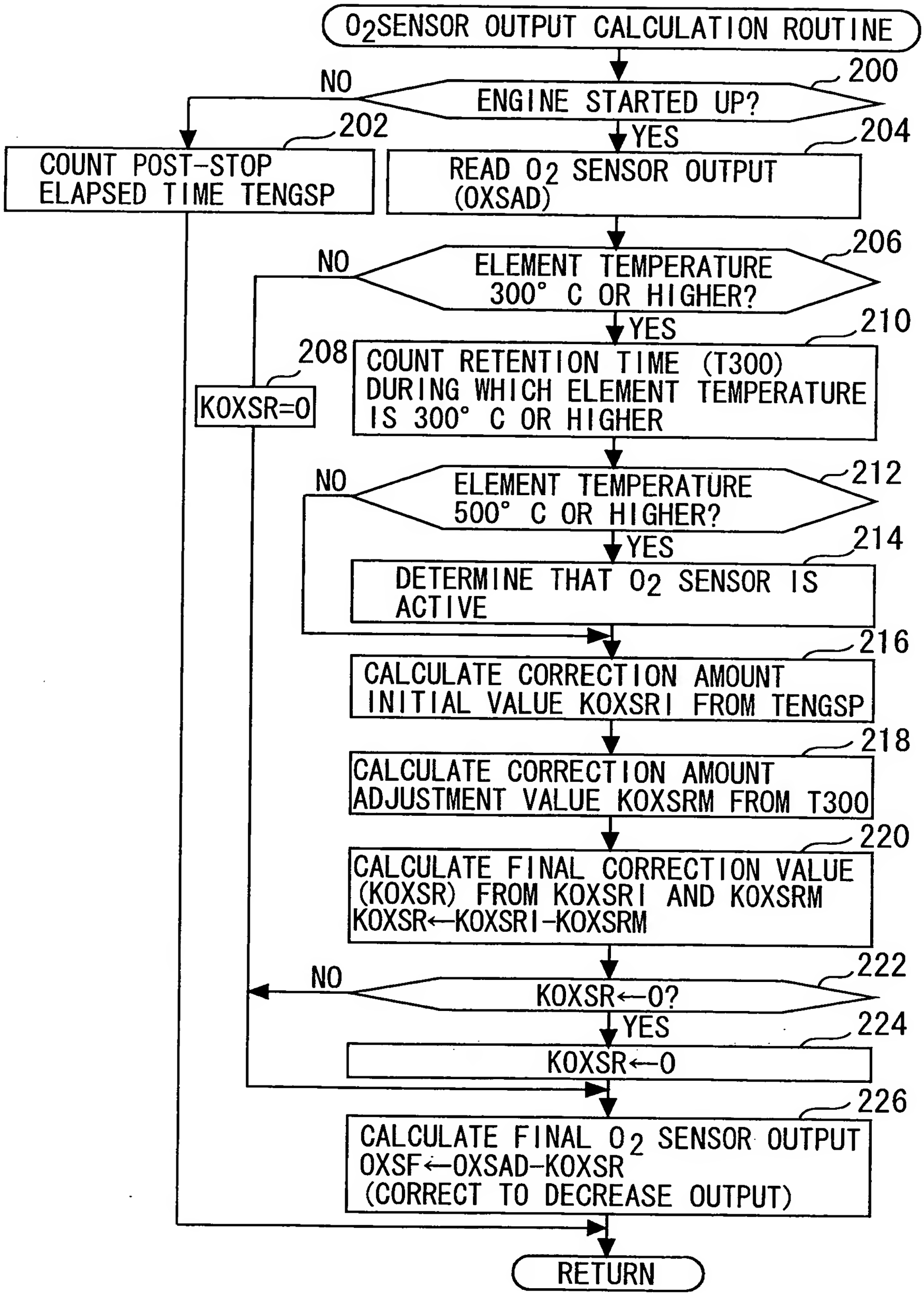
O2SENSOR OUTPUT CALCULATION ROUTINE
200
ENGINE STARTED UP?
NO
YES
202
COUNT POST-STOP ELAPSED TIME TENGSP
204
READ O2 SENSOR OUTPUT (OXSAD)
206
ELEMENT TEMPERATURE 300° C OR HIGHER?
NO
YES
208
KOXSR=0
210
COUNT RETENTION TIME (T300) DURING WHICH ELEMENT TEMPERATURE IS 300° C OR HIGHER
212
ELEMENT TEMPERATURE 500° C OR HIGHER?
NO
YES
214
DETERMINE THAT O2 SENSOR IS ACTIVE
216
CALCULATE CORRECTION AMOUNT INITIAL VALUE KOXSRI FROM TENGSP
218
CALCULATE CORRECTION AMOUNT ADJUSTMENT VALUE KOXSRM FROM T300
220
CALCULATE FINAL CORRECTION VALUE (KOXSR) FROM KOXSRI AND KOXSRM
KOXSR←KOXSRI-KOXSRM
222
KOXSR←0?
NO
YES
224
KOXSR←0
226
CALCULATE FINAL O2 SENSOR OUTPUT
OXSF←OXSAD-KOXSR
(CORRECT TO DECREASE OUTPUT)
RETURN

FIG. 12A

KOXSRI MAP FOR TENGSP

TENGSP[s]	3000	10000	50000
KOXSRI[V]	0.0	0.1	0.2

FIG. 12B

KOXSRM MAP FOR TENGSP

T300[s]	30	100	180
KOXSRM[V]	0.0	0.1	0.2
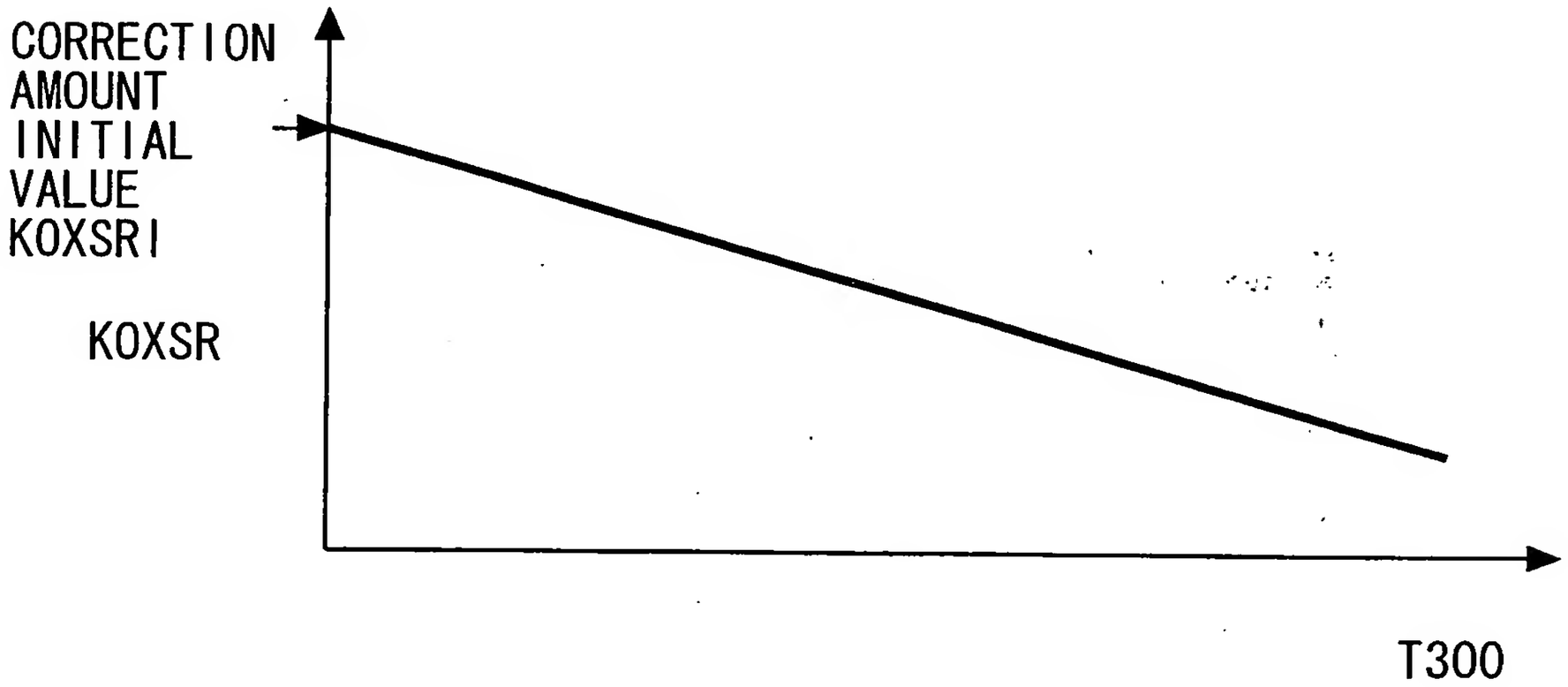
FIG. 12C